PMC-ND

(1.08.09.13)

U.S. DEPARTMENT OF ENERGY
OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY
NEPA DETERMINATION

RECIPIENT: UC San Diego **STATE:** CA

PROJECT TITLE : Enhanced production of algae lipids and carbohydrates for fuel and polyurethane precursors

Funding Opportunity Announcement Number	Procurement Instrument Number	NEPA Control Number	CID Number
DE-FOA-0002423	DE-EE0009671	GFO-0009671-001	GO9671

Based on my review of the information concerning the proposed action, as NEPA Compliance Officer (authorized under DOE Policy 451.1), I have made the following determination:

CX, EA, EIS APPENDIX AND NUMBER:

Description:

A9 Information gathering, analysis, and dissemination	Information gathering (including, but not limited to, literature surveys, inventories, site visits, and audits), data analysis (including, but not limited to, computer modeling), document preparation (including, but not limited to, conceptual design, feasibility studies, and analytical energy supply and demand studies), and information dissemination (including, but not limited to, document publication and distribution, and classroom training and informational programs), but not including site characterization or environmental monitoring. (See also B3.1 of appendix B to this subpart.)
B3.6 Small-scale research and development, laboratory operations, and pilot projects	Siting, construction, modification, operation, and decommissioning of facilities for smallscale research and development projects; conventional laboratory operations (such as preparation of chemical standards and sample analysis); and small-scale pilot projects (generally less than 2 years) frequently conducted to verify a concept before demonstration actions, provided that construction or modification would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible). Not included in this category are demonstration actions, meaning actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment.
B5.15 Small-scale renewable energy research and development and pilot projects	Small-scale renewable energy research and development projects and small-scale pilot projects, provided that the projects are located within a previously disturbed or developed area. Covered actions would be in accordance with applicable requirements (such as local land use and zoning requirements) in the proposed project area and would incorporate appropriate control technologies and best management practices.

Rationale for determination:

The U.S. Department of Energy (DOE) is proposing to provide funding to the University of California San Diego (UCSD) to bioengineer multiple commercially viable strains of algae capable of producing molecules (i.e. precursors) that would be used for the production of polyurethane (PU) products and biofuel.

Early award activities at UCSD laboratory facilities would involve the characterization of two commercial strains of algae and their naturally occurring lipids and carbohydrates to determine potential precursor candidates that would be ideal targets for later bioengineering activities. These activities would involve the growth of small laboratory-scale cultures and use of chromatography, spectrometry, and assay technologies. Growth mediums of these cultures would later be manipulated in the laboratory to assess algae productivity in environments of high pH (greater than 10) and high salt concentrations. While these characterization activities would be taking place, UCSD would test and adapt preexisting genetic tool sets (i.e. genetic engineering technologies and genetic sequences) to algae strains for this project in an effort to successfully manipulate the genetic expression of strains to optimize production of precursors.

After collecting sufficient baseline data on algae productivity, UCSD would manipulate the environmental conditions of the algae cultures in a laboratory setting to increase the genetic diversity of the algae specimens (i.e. mutagenesis via ultraviolet (UV) irradiation and genome shuffling via breeding and/or cell fusions). The resulting algae strains would be subjected to growth mediums of increasing salt concentrations to direct the evolution of the surviving strains to tolerate high-salt environments. The surviving strains would later be genetically engineered (using the aforementioned genetic tool sets) to improve productivity and biomass quality. The genetically modified strains would again be subjected to environmental manipulation in the laboratory to increase genetic diversity of the genetically modified algae cultures.

From these cultures, optimal strains would be identified and selected to be cultivated in existing raceway ponds within

a UCSD field station greenhouse that has been certified by the U.S. Environmental Protection Agency (EPA) for growth of genetically modified algae. Algae cultures produced in the greenhouse would be approximately 200-300 liters in volume. Biomass and precursor yields from these cultures would be evaluated to determine the productivity of the algae strains. All equipment and raceways used to cultivate genetically modified algae strains for this award would be sterilized with bleach cleaning solutions.

Project activities that would produce PU monomers (i.e. “building blocks” for PUs) and biofuel would be conducted concurrently to aforementioned algae cultivation and bioengineering activities. Such activities would begin with the extraction and purification of precursors (i.e. carbohydrates, lipids, and succinic acid) from algae biomass. Later, methods for chemically converting the PU precursors (PUPs) to PU monomers would be developed (focusing on flow chemistry technologies) and tested. If the developed methods prove successful, the methods would be adapted for larger-scale production of PU monomers (in a laboratory setting) which would be tested to produce monomers on a scale of grams. Monomers produced would be used to create PUs which in turn would be used to create PU products such as films, foams, and thermoplastics using existing technology such as a FlackTek SpeedMixer and low pressure injection machine. Concurrent to PU product fabrication activities, biofuel would be produced at laboratory scale via catalytic hydrogenation.

UCSD would perform a portion of award laboratory activities in collaboration with their industry partner, Algenesis. Algenesis would provide support for the following activities: developing detections assays for PUPs, purifying succinic acid from algae biomass, develop and perform methods for PUP isolation and conversion to PU monomers, and produce PUs. Algenesis would lead collaborative efforts for the following activities: formulate thermoplastic PUs (TPUs), prototyping a commercially viable TPU product, formulate PU foams, and production of PU foam products. All support provided by Algenesis would occur in UCSD facilities.

The UCSD laboratory and greenhouse facilities are preexisting purpose-built facilities for the type of work to be conducted for this project. Facility modifications would not be required. Project activities would involve the handling and use of hazardous materials, including chemical reagents and solvents. All such handling and storage would occur within laboratory settings at UCSD and would follow existing policies and procedures for handling and disposal of these materials. Handling and disposal of genetically modified algae at all facilities would be done in accordance with existing federal, state, and local laws and regulations. Existing university health, safety, and environmental policies and procedures would be followed at all facilities, including: personnel training, proper personal protective equipment (PPE), engineering controls, monitoring, and internal assessments.

Project activities would also include a life cycle assessment (LCA) and technoeconomic assessment (TEA). These activities would be of an intellectual, academic, and analytical nature and would be completed at the University of California Davis (Davis, CA). All other project activities would occur within controlled laboratory and greenhouse settings at UCSD.

NEPA PROVISION

DOE has made a final NEPA determination.

Notes:

Bioenergy Technologies Office (BETO)
This NEPA determination does not require a tailored NEPA Provision.
NEPA review completed by Dan Cahill, 11/24/2021.

FOR CATEGORICAL EXCLUSION DETERMINATIONS

The proposed action (or the part of the proposal defined in the Rationale above) fits within a class of actions that is listed in Appendix A or B to 10 CFR Part 1021, Subpart D. To fit within the classes of actions listed in 10 CFR Part 1021, Subpart D, Appendix B, a proposal must be one that would not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, or similar requirements of DOE or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities (including incinerators), but the proposal may include categorically excluded waste storage, disposal, recovery, or treatment actions or facilities; (3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that preexist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources, including, but not limited to, those listed in paragraph B(4) of 10 CFR Part 1021, Subpart D, Appendix B; (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species, unless the proposed activity would be contained or confined in a manner designed and operated to prevent unauthorized release into the environment and conducted in accordance with applicable requirements, such as those listed in paragraph B(5) of 10 CFR Part 1021, Subpart D, Appendix B.

There are no extraordinary circumstances related to the proposed action that may affect the significance of the environmental effects

There are no extraordinary circumstances related to the proposed action that may affect the significance of the environmental effects of the proposal.

The proposed action has not been segmented to meet the definition of a categorical exclusion. This proposal is not connected to other actions with potentially significant impacts (40 CFR 1508.25(a)(1)), is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1508.27(b)(7)), and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211 concerning limitations on actions during preparation of an environmental impact statement.

The proposed action is categorically excluded from further NEPA review.

SIGNATURE OF THIS MEMORANDUM CONSTITUTES A RECORD OF THIS DECISION.

NEPA Compliance Officer Signature: Electronically Signed By: Roak Parker Date: 11/29/2021

NEPA Compliance Officer

FIELD OFFICE MANAGER DETERMINATION

- [x] Field Office Manager review not required
- [ ] Field Office Manager review required

BASED ON MY REVIEW I CONCUR WITH THE DETERMINATION OF THE NCO :

Field Office Manager's Signature: _____ Date: _____

Field Office Manager